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Forbes

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WARREN BUFFETT ON PHIL FISHER

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Forbes

OCTOBER 19, 1987
VOLUME 140
NUMBER 8

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October 19, 1987 Volume 140 Number 8 Forbes (ISSN 0015 6914) is published biweekly except weekly during two weeks in April and two weeks in October, by Forbes Inc., 60 Fifth Ave., New York, N.Y. 10011. Second-class postage paid at New York, N.Y. and at additional mailing offices. Subscription $45 a year, U.S.A. Postmaster: Send address changes to Forbes, 60 Fifth Ave., New York, N.Y. 10011.

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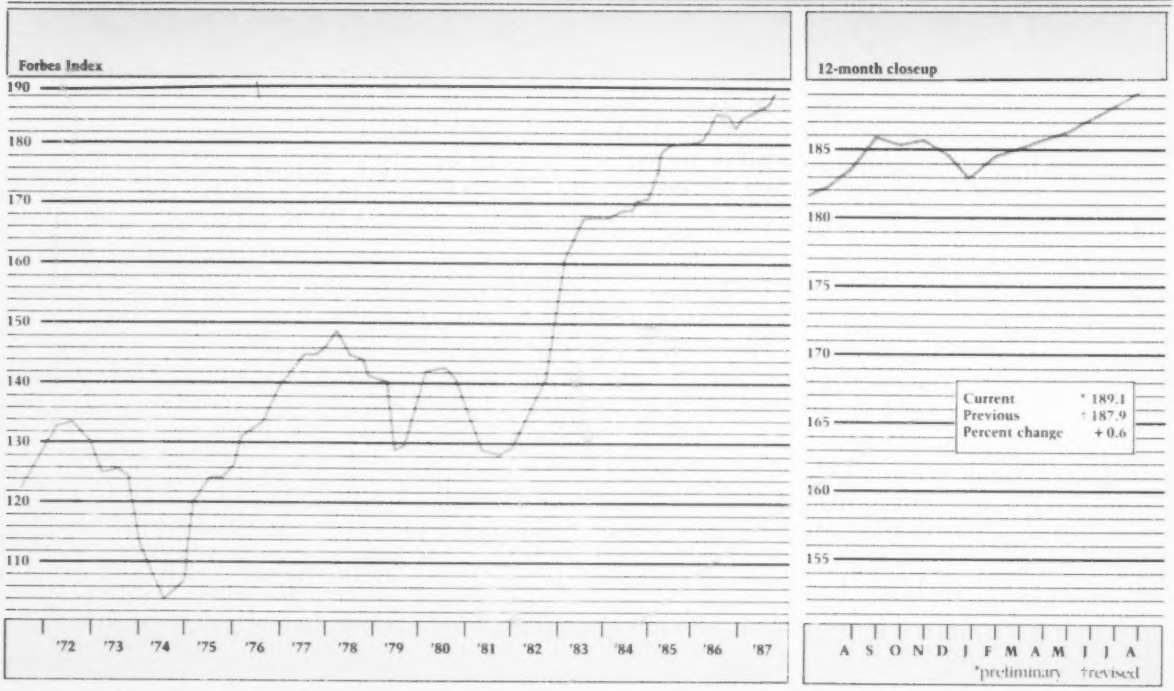
The Forbes Index



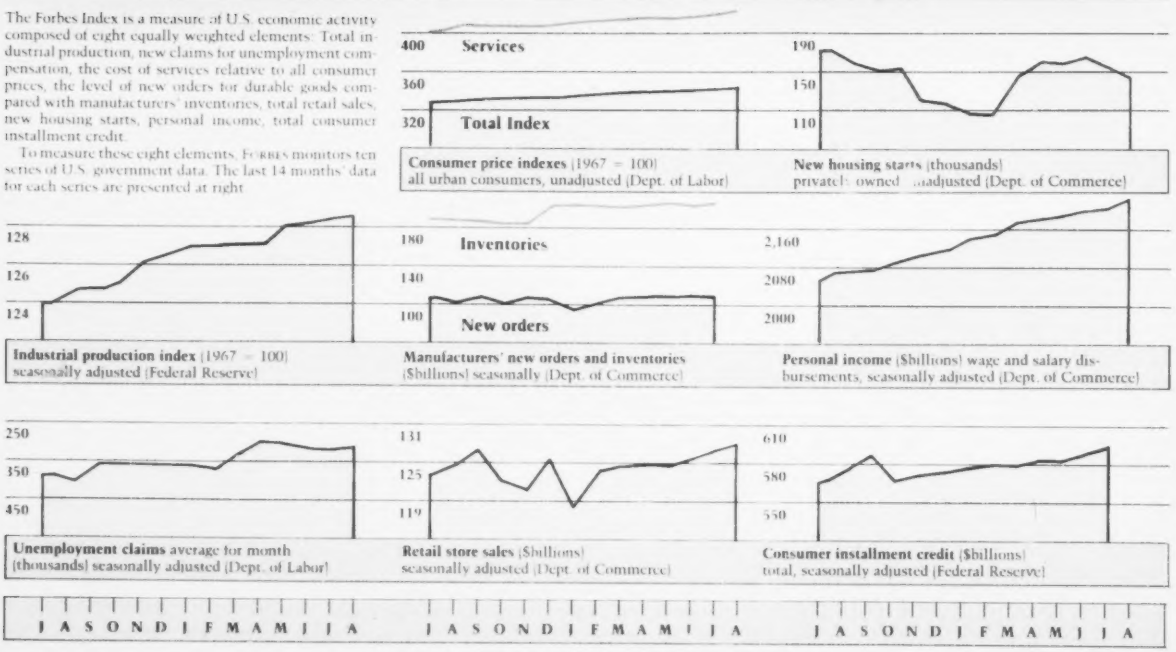
Where will we live? Rising mortgage rates continue to weaken the housing sector. The 12-month total of housing starts fell 1.2% in August. The number of new starts in August, 143,600, was the lowest total for this month in five years.

Despite the weakness in housing, however, The Forbes Index rose 0.6% on the strength of gains posted by other sectors. Retail sales increased 1.3% in August, the biggest jump in six months, to an annual $1.54 trillion. Consumer spending is likely to remain strong. Personal income rose 0.9% from July to August, to an annual rate of $2.22 trillion. Strong gains in the output of business equipment and consumer goods supported a 0.3% increase over the July figure for industrial production.

The Forbes Index Components

The Forbes Index is a measure of U.S. economic activity composed of eight equally weighted elements: Total industrial production, new claims for unemployment compensation, the cost of services relative to all consumer prices, the level of new orders for durable goods compared with manufacturers' inventories, total retail sales, new housing starts, personal income, total consumer installment credit.

To measure these eight elements, FORBES monitors ten series of U.S. government data. The last 14 months' data for each series are presented at right.


400
360
320
Services
Total Index
Consumer price indexes (1967 = 100) all urban consumers, unadjusted (Dept. of Labor)
190
150
110
New housing starts (thousands) privately owned, unadjusted (Dept. of Commerce)
128
126
124
Industrial production index (1967 = 100) seasonally adjusted (Federal Reserve)
180
140
100
Inventories
New orders
Manufacturers' new orders and inventories ($billions) seasonally (Dept. of Commerce)
2,160
2080
2000
Personal income ($billions) wage and salary disbursements, seasonally adjusted (Dept. of Commerce)
250
350
450
Unemployment claims average for month (thousands) seasonally adjusted (Dept. of Labor)
131
125
119
Retail store sales ($billions) seasonally adjusted (Dept. of Commerce)
610
580
550
Consumer installment credit ($billions) total, seasonally adjusted (Federal Reserve)
J A S O N D J F M A M J J A
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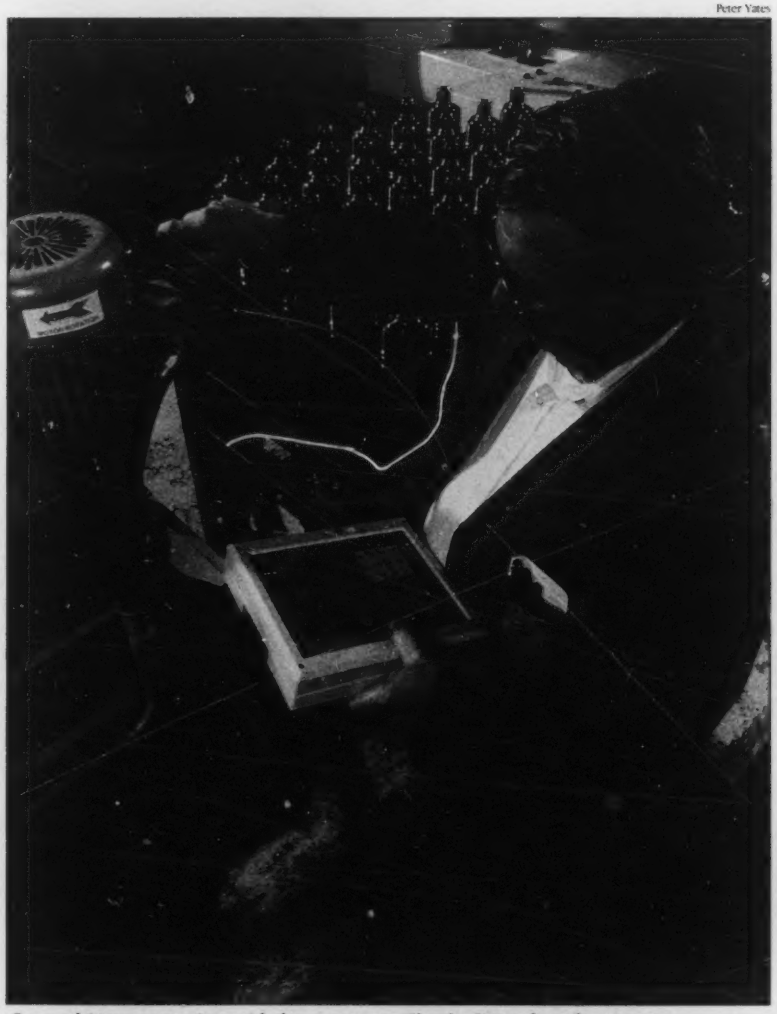
Science & Technology

Edited by Gary Slutsker

What happened to those "expert systems" that were supposed to transform the world of business forever? Expectations got way ahead of reality.

The morning after

Peter Yates



General Motors repairman helps computer Charlie listen for vibrations
Visions of computers that would run factories and design products.

By Ruth Simon

EVERY WORKING DAY for more than 20 years, ace manufacturing engineer Charlie Amble would drive the short commute from his Michigan home to General Motors' Saginaw plant. Once there, he would put down his lunch pail and pick up a headset. Attaching a series of sensors to lathes and grinders, Charlie would proceed to spend the day listening for vibrations that told him how well GM's machine tools were building axles and steering gears for its cars and trucks.

In 1986 Charlie Amble retired. General Motors replaced him with a computer that could "listen." So far, that device, dubbed "Charlie" in honor of the human it replaced, represents one of the automaker's few successful forays into the world of artificial intelligence.

Computer Charlie has been a relative success. But where GM has tried to use artificial intelligence to build huge, so-called expert systems, the company has come a cropper. So have most other big companies.

Expert systems, the most widely used commercial application of artificial intelligence, use inferential reasoning to draw conclusions from a huge knowledge base. But, basically, all companies involved in the development of expert systems have encountered one aspect or another of the same fundamental problem: how to mimic, electronically, creative qualities such as learning, invention, intuition or common sense.

Thus, Security Pacific Corp.'s attempts to build an expert system for foreign exchange trading have been stymied by the need to get the machine to evaluate qualitative information with emotional content, such as news stories. Is Paul Volcker replaced as head of the Fed? Do Iranian fanatics attack a U.S. Navy ship in the Persian Gulf? What these things mean to relative prices of dollars and yen differs according to circumstances so complex that no computer can be programmed to handle them. Computer Charlie's listening for vibrations is an infinitely simpler task.

Even seemingly trivial problems can foul up expert systems. Early field tests of a system designed to free Ford Motor Co. credit analysts from approving routine car loans flopped for lack of "common sense." Without human experience, the system had no reason to question an application from a 20-year-old who claimed ten years of work experience.

Another potential problem is the limited knowledge of an expert sys-

Overblown expectations

Expert systems software suppliers went public capitalizing on overheated investor expectations, which turned out to be impossible to deliver anytime soon. Now, industrywide losses have kept share prices of these publicly held firms at or below their initial offering prices.

Company	Went public	Initial offering price per share	Current price	Revenues ($thousands)	Net income ($thousands)
Transform Logic	9/83	$0.87	$0.87	$6,630	$–250*
ExperTelligence	11/83	0.10	0.02	850	–306†
IntelliCorp	12/83	6.00	5.62	20,352	–3,987
Symbolics	11/84	6.00	3.87	103,787	–25,544
Teknowledge	3/86	13.00	12.50	20,459	–2,822

*Fiscal year 1986. Fiscal year 1987 ends Oct. 31, 1987. †Fiscal year 1986. Fiscal year 1987 ends Sept. 30, 1987.

Science & Technology

tem. Concedes Stanford Professor Edward Feigenbaum, an artificial intelligence pioneer: "When you reach the edge of its expertise it falls off from very good to very bad."

Only a couple of years ago, seduced by visions of companies developing computer systems to run entire factories or to design whole new product lines automatically, investors poured $440 million into startup companies like ExperTelligence and IntelliCorp. Yet since then barely 100 major expert systems have been installed nationwide, mostly to handle such mundane tasks as production scheduling and equipment diagnosis. Meanwhile, the stocks of those once high-flying startups now trade at or below their initial offering prices *(see table)*.

For some venture capitalists, the words artificial intelligence have become a kind of curse. "A lot of investors learned about expert systems the hard way," says Thomas Farb, managing director of Lincoln, Mass.' AI Fund, a venture capital firm. In an effort to rub out all trace of its roots in artificial intelligence, one Waltham, Mass. firm, Natural Intelligence Corp., has lately even gone so far as to change its name to the vague moniker Event Technologies, Inc.

Successes for the infant industry have been few—and costs are high. Digital Equipment Corp. now spends $2 million yearly just to update a database of 10,000 logical rules used by its XCON expert system to help the firm's salesmen configure computer systems for various client applications. A moderate-size expert system, which would comprise maybe 300 rules, typically runs $250,000 to $500,000 just to design.

Fred Mertz

Lee Hecht of Teknowledge
"We didn't have a commercial product."

This spells bad news for the 100 or so firms that make up the expert systems industry. Sales of expert systems account for only a fraction of the revenues of giants like Xerox and Texas Instruments, but are vital to the survival of startups like Aion of Palo Alto, Calif., or Gold Hill Computers of Cambridge, Mass.

Blood is turning up on more and more income statements. The two leading expert systems software producers, Teknowledge and IntelliCorp, reported losses of $2.8 million and $4 million in the fiscal year ending June 30. A $25.5 million loss forced Symbolics, a manufacturer of artificial intelligence computers, to chop 17% of its employees and move from fancy new digs back into its original cramped Cambridge, Mass. headquarters. Meanwhile, Symbolics' arch-competitor Lisp Machines Inc. no sooner filed for Chapter 11 protection than the hardware manufacturer was acquired in June by a Canadian computer distributor.

"The expectations were Buck Rogers-like," confesses Lee Hecht, chairman of Teknowledge, one of the early expert systems pioneers, founded by 18 Stanford researchers. But once in business, the firm confronted a problem. "We didn't have a commercial product," says Hecht, who joined the company in October 1981, becoming the third chief executive in as many months.

What did Teknowledge do? As with many other companies in the same situation, its strategy has been to market the software needed to write artificial intelligence programs—sort of computer do-it-yourself kits for industry. The tool kits have not sold well. For one thing, they are both ex-

pensive and difficult to use. Most of the early programs were written in Lisp, a specialized computer language well suited to developing expert systems, but so extraordinarily complex as to require special computers and software interfaces to link up with a customer's existing computer system.

Jerry Peterson, Ford Motor's director of corporate systems development, complains: "The industry hasn't given us a way to develop and deploy these systems in a conventional data processing environment."

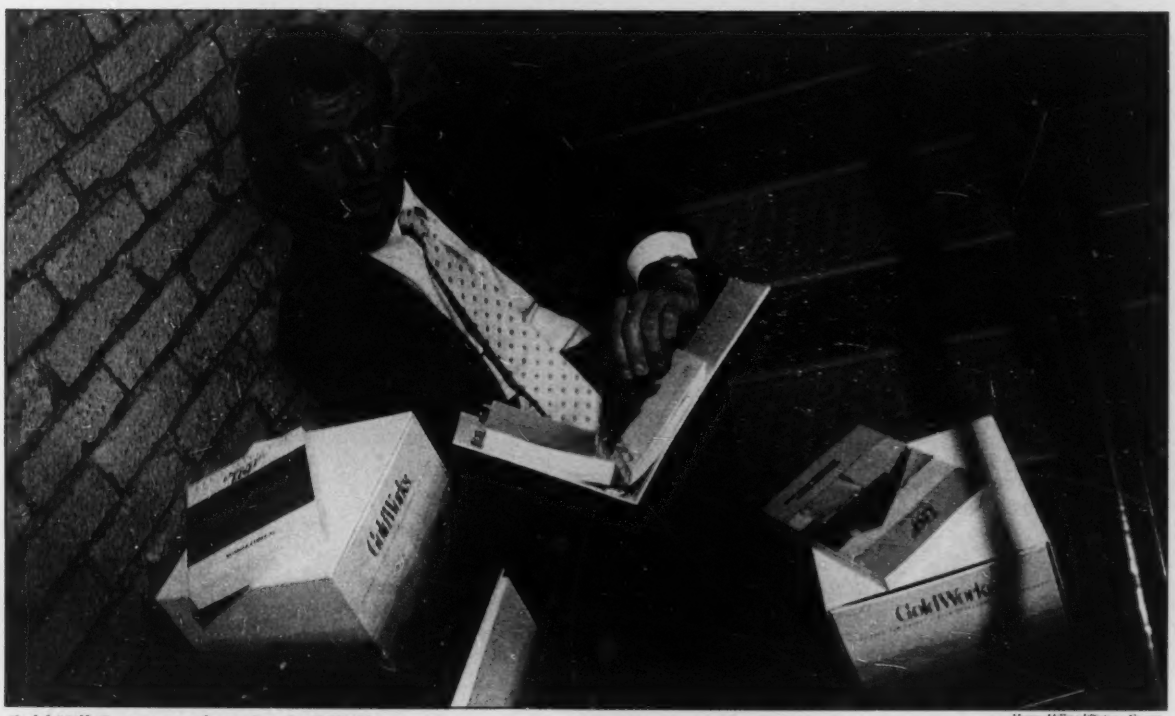
Harry Reinstein spent 22 years working in product development at IBM before founding Aion Corp., an expert systems software vendor based in Palo Alto, Calif. He reminds himself and his competitors: "A large segment of the commercial marketplace just doesn't want technology, it wants solutions."

Abandon hope? Not necessarily. While most of the industry is struggling, a few companies have spotted opportunities. Reinstein's three-year-old Aion, for example, develops non-Lisp software specifically for IBM computers instead of Lisp-based machines. Likewise, Gold Hill Computers became profitable in August by selling Lisp software for personal computers.

The challenge for the industry now is thus to stop dreaming of the ultimate payoff from artificial intelligence and start looking around for more such opportunities closer to home. When AT&T Bell Laboratories came up with an expert system for identifying chronic cable problems, the company sensed that it was onto something marketable, and has since sold the system to five regional Bell operating companies. Capitalizing on opportunities like that is where artificial intelligence's future really lies. ■

Ron Grant Tuss

Stanford's Professor Edward Feigenbaum
Can a computer respond emotionally when a U.S. ship is attacked?

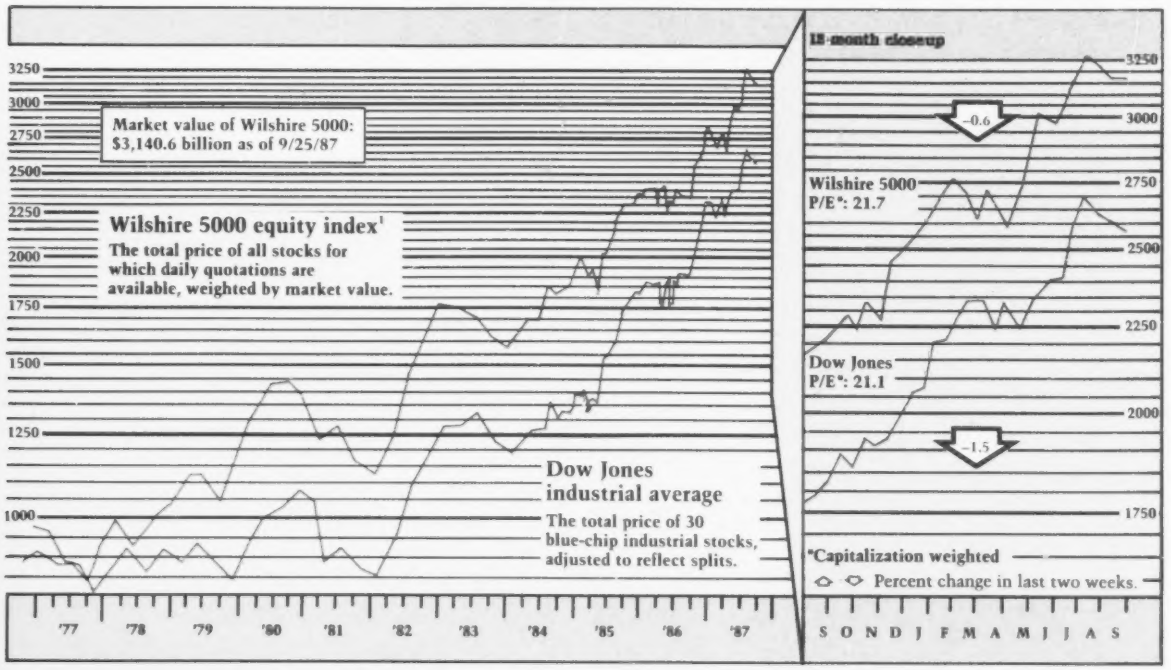


Henry Hilliard/Picture Group

Gold Hill Computers founder Carl Wolf
Customers want solutions, not technology.

The Forbes/Wilshire 5000 Review

Edited by Steve Kichen


Market value of Wilshire 5000: $3,140.6 billion as of 9/25/87
Wilshire 5000 equity index[1]
The total price of all stocks for which daily quotations are available, weighted by market value.
Dow Jones industrial average
The total price of 30 blue-chip industrial stocks, adjusted to reflect splits.
18-month closeup
Wilshire 5000 P/E*: 21.7
Dow Jones P/E*: 21.1
-0.6
-1.5
*Capitalization weighted
Percent change in last two weeks.
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
'77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87
S O N D J F M A M J J A S

End of the correction? Could be. The Dow industrials had been off as much as 230 points from their late August all-time high. "There wasn't a lot of money coming out when the market was going down," says Steven Goldstein, a vice president at New York-based Knight-Ridder Tradecenter. Goldstein's firm measures money flow by taking stock price times volume on upticks and subtracting stock price times volume on downticks. On Sept. 22 the Dow posted a record 75-point advance, and this gain was generally sustained by trading during the rest of the week. According to Goldstein, the 75-point jump in the Dow also marked the fourth-highest peak in positive money flow into the market.

Although the market ended up in the loss column for the four-week and two-week periods, the major indexes finished the final week (ended Sept. 25) with small gains. The Dow was up 1.8%, the NYSE 1.6% and the Wilshire 1.3%. Both the Amex and the Nasdaq rose less than 0.3%.

Closeup On the Equity Markets

Performance of six leading indexes

Percent change	Wilshire 5000	Forbes 500[2]	Dow Jones industrials	NYSE Composite	Amex Market Value Index	NASDAQ Composite
in last 4 weeks	–2.2	–0.8	–2.6	–2.1	–1.5	–2.5
in last 52 weeks	33.1	36.1	45.2	33.7	35.3	25.7

Stock performance based on six key investor yardsticks

Percent change	Company size		Volatility[3]		P/E multiple		Dividend yield		Growth profile[4]		Share price	
	large	small	high	low	over 25	under 5	over 7.5%	none	high	low	over $40	under $4
in last 4 weeks	–2.4	0.6	1.6	–1.4	–1.6	–1.8	–2.2	1.0	0.5	–1.5	–1.8	–0.3
in last 52 weeks	33.3	53.9	77.5	24.2	35.2	19.7	10.9	69.1	71.5	21.9	30.5	44.7

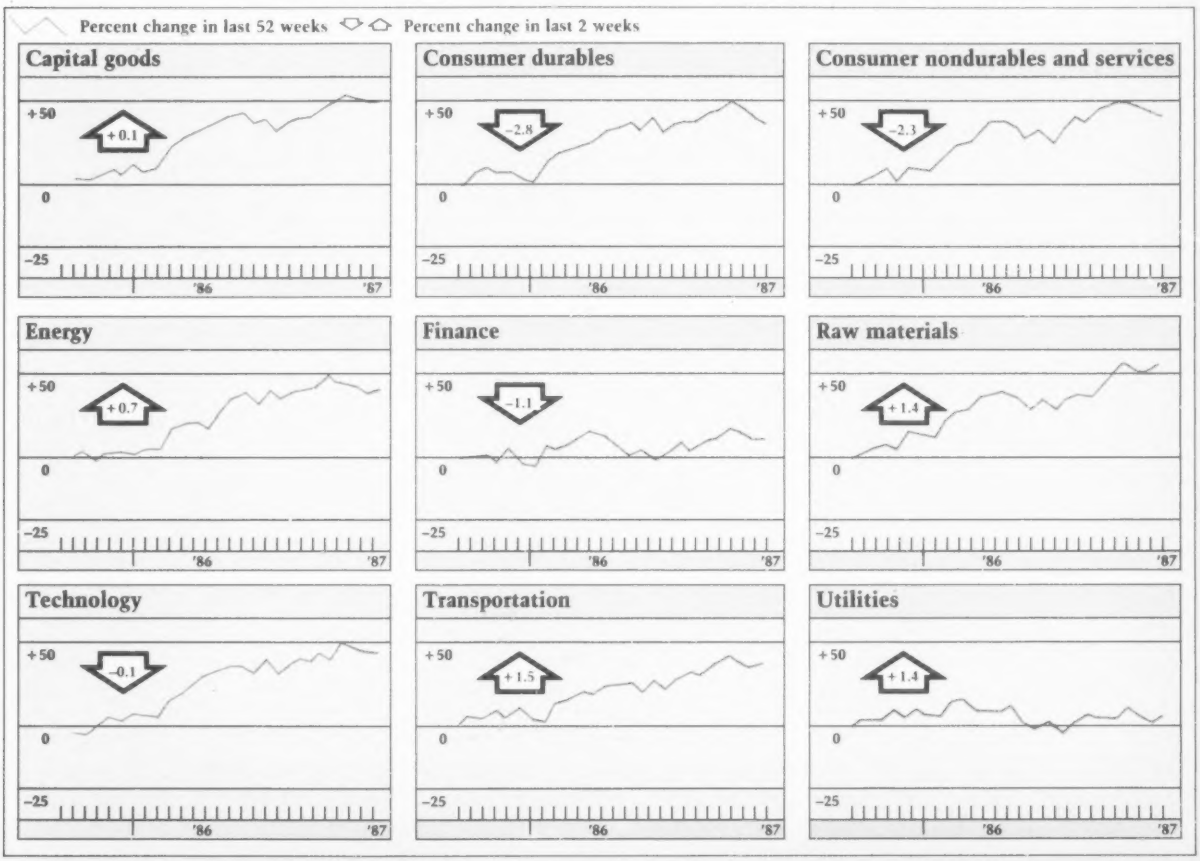
[1]Wilshire index reflects price performance. It differs slightly from market value of outstanding stocks because of retirements of equity since index was created. [2]Based on sales. [3]A stock's sensitivity to overall market movement. High-volatility issues have wide price fluctuations, low-volatility issues are more stable. [4]A quantitative evaluation of a stock's growth image, determined by Wilshire Associates.

Note: All data for periods ending 9/25/87. Prepared by Wilshire Associates, Santa Monica, Calif.

Where the Action Is

Transportation, utilities and raw materials were the strongest sectors in a weak market. Transportation issues led with a 1.5% gain. Both utilities and raw materials rose 1.4%. Over the last 52 weeks the raw materials group shows the largest gain, an increase of 57.2%. This diverse group includes some service companies, such as Computer Sciences, as well as firms engaged in the mining of natural resources. Over the last two weeks the best stock in this sector was Norton Co., which gained almost 15%.

In contrast, the two consumer sectors fell more than twice the market. Auto and auto-related stocks, such as Genuine Parts, B.F. Goodrich, Champion Spark Plug and auto-importer Subaru of America, lost between 7% and 9%. Anticipated weak earnings knocked Gap down 39%.



What the Analysts Think

Spotlight on raw materials. Security analysts continue to raise their 1987 earnings estimates for the raw materials group. Among stocks with upgraded forecasts are Commercial Metals, Inspiration Resources, NCH and Inco. Smaller estimate increases were made for three other sectors: capital goods, energy and utilities.

Forecasting the Forbes Sales 500

Performance period	Average earnings per share	P/E
latest 12 months	$2.31	20.8
1987 estimates	2.92	16.4
1988 estimates	3.78	12.7

Rank based on change in estimate	Sector	Estimated 1987 EPS	Estimated 1987 P/E	% change in 1987 estimate in 2 weeks	% change in 1987 estimate in 4 weeks
1	Raw materials	$2.33	18.1	0.32%	1.25%
2	Capital goods	2.08	22.0	0.12	0.51
3	Energy	2.36	18.5	0.04	0.82
4	Utilities	2.43	10.9	0.01	0.00
5	Consumer durables	4.31	13.9	−0.08	0.17
6	Consumer nondurables	2.32	18.3	−0.18	−0.15
7	Technology	2.47	18.5	−0.30	−0.48
8	Finance	1.74	19.2	−1.12	−3.40
9	Transportation	2.19	17.1	−1.20	−1.60

Earnings projections are capitalization weighted consensus estimates from over 2,000 security analysts. Data are compiled and updated continually by the Institutional Brokers Estimate System (IBES), a service of Lynch, Jones & Ryan, a New York-based brokerage firm.

Note: All data for periods ending 9/25/87. Prepared by Wilshire Associates, Santa Monica, Calif.; IBES, a service of Lynch, Jones & Ryan, New York.